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ABSTRACT

This report contains the results of a review process and specifically addresses the indicators of progress and achievement which include student impact, teacher impact, policy changes, resource changes, management change, data utilization, learning infrastructure change, student performance, and partnerships. The review was designed to gain a full understanding of the appropriately-documented, effectively-measured, significant, and reliable indicators by which progress is assessed according to the Statewide Systemic Initiative (SSI) Program objectives. (DDR)

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1998 Program Effectiveness Reviews (PER) Report
Statewide Systemic Initiatives (SSI) Program
December 17, 1997

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January 21, 1998

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1998 Program Effectiveness Reviews (PER) Report
Statewide Systemic Initiatives (SSI) Program

I. Introduction: The SSI Program

Program Effectiveness Reviews: With congressional passage of the Government Performance and Results Act (GPRA) of 1993, starting in FY1999, the National Science Foundation (NSF) budget requests must be outcomes-based. For the Directorate for Education and Human Resources (EHR) portfolio, it must be demonstrated how the Directorate's activities and programs fulfill the relevant goal of the NSF Strategic Plan, "excellence in science, mathematics, engineering and technology education at all levels", and yield value to the American public. Moreover, the recently initiated examination of the science, mathematics, engineering, and technology portfolio by the Education and Human Resources Committee of the National Science Board and the increased interest by the Administration and Congress in demonstrated program effectiveness, have also contributed to this time of measurement, interpretation, documentation of the progress of the projects funded, and the call for more explicit and timely responses to questions that bear on the returns on investments made under the rubric of EHR's programming.

The Program Effectiveness Reviews (PER) specifically addressed the following indicators of progress/achievement:
(i) student impact,
(ii) teacher impact,
(iii) policy changes,
(iv) resource changes,
(v) management change,
(vi) data utilization,
(vii) learning infrastructure change,
(viii) student performance, and
(ix) partnerships.

The Statewide Systemic Initiative (SSI) Program is one of a select number of programs subjected to the effectiveness review, which focuses on project (in the aggregate program) outputs, outcomes, and impacts. The review was designed to gain a full understanding of the appropriately documented, effectively measured, significant, and reliable indicators by which progress is assessed as per the SSI Program objectives, design and implementation strategies, and the financial resources expended.

SSI Program Objectives and Design: The President and governors have articulated an ambitious set of national goals, including the goal of making the United States *first in the world in mathematics and science by the year 2000*. Achieving these goals require wide-ranging changes in both policy and practice.

The NSF believes that state leadership is critical to reform efforts in schools. States not only have the constitutional authority for education, but they are the only level of the

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education system that can influence all of the K-12, as well as many aspects of postsecondary education, such as teacher preparation, certification, and licensure. They are in a position to coordinate resources from a variety of public and private sources and change regulations and policies. In addition, they are able to allocate resources across the state fairly and equitable.

The mission of the EHR's Division of Educational System Reform (ESR) is to stimulate the reform of science and mathematics education in the United States so that every student experiences challenging instruction that allows his or her abilities to be fully developed and that prepares her or him well for life and work in an increasingly technological world in the years to come. This responsibility is national in its dimensions, even though NSF's role is essentially *catalytic*. Most of the resources that will be required to attain systemic reform objectives, if the mission is to be realized, will come from sources other than NSF. Nevertheless, the Foundation desires to effectively leverage those resources to enable *a unitary program of high-quality, equitable education for each student in the Nation.*

Consequently, the NSF solicited proposals by states intended to generate comprehensive systemic reform designed to achieve significant improvements in science, mathematics, and engineering education. Also, these reform efforts are aimed at broadening the impact, accelerating the pace, and increasing the effectiveness of improvements in science, mathematics, and engineering education in both K-12 and post-secondary levels. The anticipated effects of these changes are:

(i) to increase the knowledge of science and mathematics acquired by all students as all educational levels;
(ii) to afford every student the maximum opportunity to acquire the habits of mind and critical thinking skills that characterize effective use of mathematics and science; and
(iii) to enable students to understand the role and influence of technology as one of a number of ways by which science and mathematics are related to the physical world and the human condition.

The NSF established the SSI Program in 1990 as a program based on three cohorts of five-year awards. It was designed to encourage more coherent and consistent policies and programs in participating states by asking states to identify the elements that, taken together, would make a difference in what students know and are able to do. States were expected to integrate into effective plans such components of systemic change as:

(i) organizational structure and decision making;
(ii) provision and allocation of resources;
(iii) recruitment and preparation of teachers and college faculty;
(iv) retention and continuing professional development of teachers and other professional personnel;
(v) curriculum content and learning goals;
(vi) delivery of instruction, including the use of educational technology;
(vii) assessment of student achievement;
(viii) facilities and equipment;
(ix) articulation within the system, and;

(x) accountability systems.

To be considered systemic, states had to identify how they would develop and manage:
(i) state commitment in terms of resources and focus;
(ii) the state's vision of mathematics and science education;
(iii) the creation of partnerships to enable the effort to succeed; and
(iv) a plan for implementing and evaluating results for both management purposes and those of accountability.

Chronology of Awards and Total Expenditures: As a result, a total of 25 states and the Commonwealth of Puerto Rico received SSI awards for terms of up to 5 years of funding and of up to approximately $2.0 million per year. The Foundation has provided a total of approximately $265 million to date to stimulate and *catalyze* selected, high-quality, systemic reform efforts designed to move quickly and purposefully to action as follows:

FY	Sites	Expenditures
FY 91 Cohort I	Connecticut, Delaware, Florida, Louisiana, Montana, Nebraska, North Carolina, Ohio, Rhode Island, and South Dakota	$14,366,266
FY 92 Cohort II	California, Georgia, Kentucky, Maine, Massachusetts, Michigan, New Mexico, Puerto Rico, Texas, Vermont, and Virginia	$42,000,000
FY 93 Cohort III	Arkansas, Colorado, New Jersey, New York, and South Carolina	$53,693,043
FY 94		$54,351,619
FY 95		$44,380,524
FY 96		$38,570,994
FY 97		$18,092,886

Management and Oversight: The SSIs and the NSF signed cooperative agreements to ensure the accomplishment of the common agreed upon goals. The initiatives are required to submit annual progress reports, including data reporting. The SSIs have been supported by technical assistance, evaluation, and monitoring contracts. In addition, every site went through the Mid-Point Review process and each site has received at least one site visit each year.

Cooperative Agreements: Cooperative agreements are used by NSF for awards when the accomplishment of the project objectives requires substantial NSF technical or management involvement during performance of the activities. Substantial NSF involvement may be necessary when an activity is technically or managerially complex, or requires extensive or close coordination with other Federally supported work.

Systemic Reform Critical Developments: In 1995, the NSF disseminated the *Instrument for Annual Report of Progress in Systemic Reform*, a guiding document that includes a description of the critical developments that drive systemic reform (drivers). It is used for

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various purposes in the SSI Program, including planning, evaluation, and reporting of the various initiatives. The six drivers are:

(i) Implementation of comprehensive, standards-based curricula;
(ii) Development of a coherent, consistent set of policies that support high-quality mathematics and science education;
(iii) Convergence of the usage of all resources into a focused and unitary program;
(iv) Broad-based support from parents, policymakers, institutions of higher education, business and industry;
(v) Accumulation of a broad and deep array of evidence that the program is enhancing student achievement; and
(vi) Improvement in the achievement of all students, including those historically underserved.

Mid-Point Reviews: Mid-Point Reviews (MPRs) are standard procedure in EHR/NSF for large-scale awards, particularly helpful in providing information on programs funded over long periods of time. The goal of these reviews is to determine the impact of the SSI awards to date, and to ascertain their potential to stimulate improvements in the future. MPRs consisted of panels of outside experts who examined the accomplishments of the SSI states and, consequently, made recommendations about future directions and funding continuation for those states. These reviews are usually followed by site visits. The results of the site visits and the panels' recommendations are shared as recommendations with the initiatives' leadership.

Technical Assistance: ESR provides technical assistance to all SSIs. This service begins with the Program Officer's analysis of the initiatives' annual reports and proposed strategic plans. Technical assistance needs are identified, discussed with the sites, and communicated to the technical assistance contractor, who provides services in three major domains:

(i) site-based technical assistance,
(ii) communications network, and
(iii) leadership development.

Annual Reports: SSIs submit annual progress reports (usually by May 15) in which they describe their major accomplishments in terms of the drivers, their impact, outcomes and strategic plans for the upcoming year. Also, sites submit data reports twice a year.

Evaluation: The National Evaluation of the SSI Program, conducted by the external contractor, SRI International, assessed the SSI as a federal strategy for improving mathematics and science education by documenting educational changes at each stage of the systemic reform process: project activities, in-state-level collaboration, state policy and practice, local and higher education delivery and policy systems, and student experience and outcomes. SRI has conducted field work in various SSI states that has resulted in reports, such as *SSI Evaluation Reports; Public Case Studies, Compilation of State Data from the Annual Reports to NSF;* as well as other resource documents, such as *The SSI Program's Impact on Students: What We Now Know and What We Expect to Learn, The*

Impact on Students of the SSI Program: A Pilot Study of the Impacts of the Louisiana and Montana SSIs

Monitoring: Abt Associates Inc. provided monitoring services to the SSI states from 1992 to 1996. Monitors visited the sites twice a year and focused their work on issues related to the implementation of the science and mathematics systemic reform plans and the analysis of the factors that contribute to the attainment of the initiatives' objectives. In addition, monitoring services focused on specific issues such as professional development, equity, standards, quality control, scaling-up, and sustainability. Reports on progress of implementation were developed and shared with Program Officers and the sites' leadership.

Site Visits: Program Officers usually conduct visits to the sites to determine evidence of progress made by the initiatives and to address particular issues. Each site is subjected to at least one visit every year.

Phase-out process: As a result of the SSI management and oversight system, the NSF determined that some initiatives had not achieved an acceptable level of development in their science and mathematics education reform efforts. Therefore, SSI awards were phased-out in **Rhode Island** in FY 1994; **Florida** in FY 1995; and **North Carolina** and **Virginia** in FY 1996.

Phase II (Continuation) process: EHR initiated a competitive process in FY 1996 through which further support is provided to a few exemplary members of each SSI cohort to extend their successful results throughout the state with the expectation of realizing a fully mature reform initiative. EHR will also continue to work with any of the members of each cohort desiring such assistance by providing advice regarding possible continuation of individual components of their systemic initiative within the framework of EHR's existing programs. Two Cohort I sites, **Louisiana** and **Connecticut**, were awarded grants in FY 1996 to continue their reform efforts for up to 5 additional years of funding of up to $1.4 million per year and totaling under $6 million. In FY 1997, NSF opened this competition to the 10 Cohort II remaining members, including **California, Georgia, Kentucky, Maine, Massachusetts, Michigan, New Mexico, Puerto Rico, Texas**, and **Vermont**. Consequently, **Massachusetts, Puerto Rico, Texas** and **Vermont** were recommended to continue their systemic reform efforts for a similar number of years. In FY 1998, Cohort III SSI states, including **Arkansas, Colorado, New Jersey, New York**, and **South Carolina** will compete for this purpose. The NSF expects to select two-three states.

As the SSIs matured, the focus of the program shifted from the development of cases or even exemplars of how K-12 science and mathematics education should be provided by a state. The focus became the mission defined earlier: the comprehensive reform of science and mathematics education in the United States. The two principal implications of this mission are:

(i) programs must be constructed that can reach most of the students in the nation, and

(ii) the results of the programs must be demonstrable--that is, impact on student attainment is critical.

In this regard, NSF does not provide funding unless a state can demonstrate both positive impact on student mathematics and science achievement attributable to the SSI and other associated and leveraged reform activities; evidence of progressive impact of the SSI, upon the state; and a compelling plan for completing scale-up to the entire state.

II. 1998 SSI PER Major Findings and Projected Actions

The 1998 SSI PER was held on December 17, 1997 at the NSF's headquarters in Arlington, Virginia. The process included the states of **Connecticut** and **Louisiana** (Cohort I, Phase II states); **Massachusetts, Puerto Rico, Texas** and **Vermont,** (Cohort II, Phase II states); and **Arkansas, Colorado, New Jersey, New York**, and **South Carolina** (Cohort III states). For the purpose of this report, the **Colorado SSI** has been excluded, because it was considered that this Initiative did not address the GPRA indicators in the 1998 PER report; thus, not providing the information and evidence requested by this process.

The following are the major findings and projected actions of the 1998 PER process derived from the SSI written reports and oral presentations. They are organized by indicators:

1. Student impact: The average percentage of students impacted by the SSI Program, particularly by full implementation of standards-based science and mathematics curricula or activities directly related to curriculum implementation in the ten SSI states participating in the 1998 PER process was approximately **51%** of the total K-12 student population in those states. The **Puerto Rico SSI** reached 200 schools in its first phase or 12% of the baseline of 1600. By working directly with an additional 200 in 1997-98, the Initiative will be reaching 25% of the public schools. During the 1997-98 school year, Puerto Rico projects to impact 65,000 students. It and has impacted directly or indirectly approximately 600,000 or 92% of all students over the last six years. Likewise, in 1997, a total of 657,841 students, or 70% of the total number of public school students in **Massachusetts**, were enrolled in SSI districts. Approximately 80% of these students, or 56% of all the students in the State, are experiencing a standards-based, inquiry-centered mathematics and science program. Similarly, the **New Jersey SSI** reported a total of 740,220 students (64% statewide) from districts with a demonstrated high level of commitment to standards-based reform, and 192,468 students (17% statewide) from districts with mid-level involvement for a total statewide 81% of students impacted in 1997. In addition, the **Arkansas SSI** informed that 87% of the 456,000 K-12 students in the State have been impacted through participating schools. Of the 1110 schools in the State, 80% or 982 schools are SSI schools and of the 311 school districts, 305 participate in one or more SSI project. The remaining SSI states reported the following percentages of students impacted: **Connecticut**-46%; **Vermont**-43%; **Louisiana**-38%, **South Carolina**-31%; **Texas**-20%; and **New York**-1.5%.

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*2. **Teacher impact :*** Overall, the SSI Program impacted approximately **40%** of the K-12 science and mathematics teachers in the reporting states through professional development programs of varied duration and intensity, and technical assistance provided to schools and school districts. **New Jersey**, for example, impacted 29,000 mathematics and science teachers (72% statewide) from districts with a demonstrated high level of commitment to standards-based reform, and over 6,500 teachers (16% statewide) from districts with mid-level involvement for an approximate 88% of teachers impacted statewide. Likewise, the **Massachusetts SSI** informed that its teachers have received over 1.3 million hours of professional development between 1992 and 1997. Of the 45,325 science and mathematics teachers in the State, 31,945 or 70% are in SSI districts. Of these, 27% have received professional development of 60-300 hours. An additional 37% of the teachers have attended 10-60 hours of mostly district-based professional development to strengthen their skills and knowledge of the curriculum frameworks. Moreover, **Vermont** has impacted 52% of its mathematics and science teachers through technical assistance provided by teacher associates and college courses as well; while **Arkansas** has assisted approximately 50% of its teachers by means of the "Crusades" (graduate courses offered to elementary and secondary teachers). Similarly, **South Carolina** impacted 30% of its mathematics and science teachers through the professional development services provided by the 13 regional hubs and the teacher specialists who offer direct assistance to schools and districts. Also, **Puerto Rico**, **Connecticut, Louisiana,** and **Texas** impacted 26%, 22%, 17%, and 7.3% of its teachers, respectively, in 1997, via various strategies, including regional demonstration centers, direct service to school districts, college courses and specialized workshops. The **New York SSI**, besides, reported that according to the State Education Department's *1997 Professional Development Surveys*, at least 90.6% of the teachers who teach in its 97 Research and Demonstration schools have participated in awareness-level activities.

*3. **Policy changes:*** SSI states have established a significant range of new strong and powerful policies and measures in support of science and mathematics education that have not only strengthened the program, but have assisted in directing its evolution as well. **Arkansas** , for example, was successful in passing the *Arkansas Public Education Act of 1997*, which establishes one core curriculum, an accountability system, and provisions for testing and assessment of standards-based curricula. The legislation is based on the premise that all students can and must meet high-quality educational standards if they are to be adequately prepared to enter the workforce. In **Vermont**, *Act 60, The Equal Education Opportunity Act* (1997) drives reform in the State by requiring many aspects of improvement: it strengthens and supports the Initiative's equity efforts, due to the financial and programmatic implications; schools must develop annual action plans and reports; there is a call for implementation of a statewide K-16 professional development plan. In addition, the State has recently approved a new mandated assessment system that includes mathematics and science testing. In **South Carolina**, high school graduation requirements were raised from three to four in mathematics and from two to three in science; **Massachusetts** added new teacher certification tests; and the State Board of Education in **New Jersey** unanimously adopted core curriculum standards with provisions for equity

planning as a result of the SSI. In addition, in **New York**, the *Regents Competency Tests* are currently being phased-out and the SSI spearheads the development of assessments aligned with standards. In **Puerto Rico**, the Secretary of the PRDE determined that all science and mathematics curricula be aligned with the SSI; and in **Texas,** the State Board of Education adopted the Texas Essential Knowledge and Skills (TEKS), including TAAS testing and accountability system. New teacher certification and licensure regulations and new teacher performance requirements were also added.

4. Resource changes: The Foundation has provided a total of approximately $265 million to date to stimulate and *catalyze* selected, high-quality, systemic reform efforts designed to ensure K-12 high-quality, standards-based mathematics education for all students statewide. In FY 1997, the NSF provided the total of $18,092,886 for this purpose—an amount that was leveraged with $391.2 million as follows: $71.2 million state funds; $281.7 million federal funds, including Title I, Eisenhower, Goals 2000, and Perkins funds; $12.4 million local government funds; and $25.9 million other funds.

Resource changes and leveraging funds are well illustrated by the following examples. The **Puerto Rico SSI** got a State Department of Education's steady cost-sharing commitment increase from $800,000 in 1992-1993, to $3.5 million in 1997 and pledges of up to $3.4 million for year 2000. In 1996, **Connecticut** received approximately $50 million of ESEA "Improving Basic Programs" funding. This funding was increased to over $59 million in 1997. The Initiative informed that while it is currently impossible to ascertain the exact amount of these funds that are used for mathematics and science education, districts are now held accountable by criterion-referenced, standards-based assessments rather that standardized norm-referenced tests. In other words, since 1996, all Title I funds currently expended by districts for mathematics and science education are directly aligned with the SSI's goals and objectives. In like manner, the **Louisiana SSI** pointed out that it has leveraged $37 million in state and federal resources since its inception in 1991. In addition, the legislature has provided $235 million in new resources to cover costs associated with assessment, professional development, accountability, and learning technologies; and since 1995, LEARN grants have provided local school districts more than $15 million for standards-based curriculum planning, local school improvement, and professional development. The **Texas SSI's** strategy for convergence of resources is to focus the attention of all educational constituencies on the TEKS. During 1997, the emphasis shifted from TEKS development and adoption to TEKS implementation. The SSI has placed an equal emphasis on the convergence of human and financial resources. In 1997, the emphasis shifted to producing resources and professional development experiences for use in the implementation of TEKS. The strategy for influencing the convergence of financial resources also focuses on the TEKS. At the heart of the strategy is a highly successful incentive grant program which requires grantees to provide matching funds. This strategy is used in five major SSI projects: pre-service mathematics, pre-service science, the *Connected Mathematics Project*, Title I, and TEXTEAMS.

In 1997, the **New Jersey SSI** leveraged $16 for every NSF SSI dollar. To promote equity and equal access to technology resources, the State's new school funding formula

designates $40 per pupil for a total of $50 million in *Distance Learning Network Aid*. In addition, the New Jersey Department of Education has allocated $12 million over two years to enable all teachers to access technology-related professional development opportunities. An additional $10 million has established new *Technology Training Centers*, located in each of the New Jersey's 21 counties. The State has committed over $287 million to improving technology resources over the next five years. Furthermore, the **Arkansas SSI** has leveraged significant amounts of funds, among which $15.6 million are state funds through the Arkansas Department of Education; and $15.2 other federal funds, including Title I, Eisenhower, and Goals 2000 funds.

The amount of leveraged funds has certainly increased in the SSI Program during 1997-1998. However, there is still the concern about significant amounts of these funds not being fully utilized to reflect a unitary mathematics and science program statewide. Title I funds, for instance, are still a major source of employment and salaries, and technology resources are used in a very piecemeal fashion, not contributing to the development of a technology vision, part of the mathematics and science systemic reform fabric.

5. Management change: Management changes have occurred in the SSI reporting states and have strengthened the various systemic reform organizational infrastructures. For example, **New Jersey**, **Arkansas**, **Massachusetts**, and **Louisiana** added science and mathematics specialists to their organizations. These specialists oversee and monitor the mathematics and science programmatic activities throughout the year, and coordinate with other existing state resources and similar efforts. Correspondingly, **South Carolina** added three new positions at the State Department of Education to support SSI efforts; and **Vermont** reported a new coordinator of information technology as well as the configuration of standards leadership teams. Overall, overseeing implementation and coordination with other ongoing efforts by these new positions, along with the roles exerted by the Principal Investigators and Project Directors have significantly contributed to the improvement of the operation of the SSI Program.

6. Data utilization: All the SSI states have designed a system to gather data, either through their own evaluation components or by direct communication and collaboration with the state departments of education. For instance, state departments of education in **New York, New Jersey**, and **Arkansas** provide "report cards" to various constituencies and have data available to the SSIs. **Puerto Rico** indicates that the program evaluation and assessment of the SSI is based on a participatory research model that provides for multiple measures of key variables that have included student academic performance, participant attitudes, participant empowerment, and professional development impact to assess the effectiveness of reform. Probably, **Vermont** is one of the best examples to illustrate the importance of data gathering and use. The State was a data-poor site when the SSI Program began. In fact, there was a statewide bias against data and a grassroots sense that data collation would be an invasion of local control. The scene has been radically changed. Today, the VT SSI bases all its improvement work on analysis of data and demonstrated need. In schools, assessment truly drives curriculum and districts insist in the gathering and analysis of data. The Initiative's external evaluation component, and

the Vermont Department of Education are the major sources for data gathering. Likewise, **South Carolina** is in the process of adding a new centralized, windows-based data collection system throughout the State. **Louisiana** gathers data and insights from a variety of sources to increase its effectiveness. These include utilizing national mathematics and science education consultants, visiting professional development and leadership sites around the State, analyzing national and international reports and journals, holding statewide retreats and meetings, and conducting internal evaluations. Analogously, the **Connecticut SSI** informed that the transformation of student performance and other educational data into meaningful information for school administrators and teachers has become the capstone of the Initiative's systemic infrastructure. It has been realized that one of the most significant impediments to achieving high-standards teaching and learning confronting school districts is the ability of educational systems to move from an almost indecipherable amount of data to a relevant and useful information system. Correspondingly, **Massachusetts** reported that the data collection, analysis and feedback process begins with information gathered from school districts by Regional Providers and SSI staff in conjunction with other Department of Education staff and the outside evaluators. Analysis is performed by the SSI staff working with staff from the Department of Education Assessment and Evaluation cluster, with assistance from Systemic Research, Inc.

Data collection does not seem to represent a problem for the SSI states. Nevertheless, the effective use of data, including its utilization during the decision-making process appears problematic through the SSIs. Furthermore, the disaggreation of data, while required for NSF's reporting does not appear to be instrumental.

*7. **Learning infrastructure change:***

(a) Standards-based curriculum: The SSI states reported substantial progress in the implementation of science and mathematics standards-based curriculum in a significant number of K-12 classrooms. Although curriculum activities vary among the reporting states—from focusing in the understanding and implementation of new science and mathematics state frameworks (e.g. **Connecticut** and **Louisiana**) to the extensive implementation of standards-based curricula at the classroom level (e.g., **Puerto Rico, Arkansas, New Jersey, and Massachusetts**)—most of them reflected understanding of high-quality curricula, knowledge of the availability of effective curricular materials, and the process that is required to implement these materials at the classroom level (e.g., use of instruments with appropriate criteria to select instructional programs consistent with their science and mathematics education vision). Instructional programs, such as Investigations in *Numbers, Data, and Space; Connected Mathematics Project; FOSS, Science and technology for Chidden; Science Education for Public Understanding Program; Chemistry in the Community; and Insights in Biology* were mentioned by most of the states to represent the generation of new curriculum projects that are being infused into the classrooms as a result of the NSF-funded systemic initiative. The **Arkansas SSI** has promoted the use of standards-based curricula in over 73% of the 311 school districts in the State. Likewise, **New Jersey** has implemented effective curricula in over 55% of

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the school districts; **South Carolina** has implemented elementary science program in over 50% of the elementary schools; and 79% of the districts in **Massachusetts** are piloting at least one of the curriculum programs—64% of the districts are implementing at least one program. In **Puerto Rico**, teams of experienced university faculty from the Natural Sciences and Education programs, as well as exemplar classroom teachers, worked collegially to review and adopt or adapt national exemplary curricula to meet local needs.

Information provided during the PER process revealed that in some states there is a significant difference between the implementation of standards-based instructional programs in science and in mathematics. **Vermont**, for instance, evidenced such a difference and explained it in terms of a lack of available curriculum materials for that subject. Although this difference had been previously acknowledged by NSF, curriculum implementation progress had also been identified in both mathematics and science. However, the lack of curriculum options in science had never been mentioned as the cause of the aforementioned difference in the implementation of curriculum products.

In spite of the fact that curriculum implementation is a rather successful activity, the reporting states evidenced a lack of a coordinated plan to scale-up implementation efforts. Some of these states, such as **Connecticut** and **Louisiana** have designed effective scale-up plans that need to be aggressively implemented within the next year, should they wish to expand statewide. The definition of the "unit of change" within the reform theory described by the states seems to be an impediment for this purpose. The identification of this unit varied from the school district to the teacher, defining a wide range of scale-up efforts and action plans.

(b) Hands-on, inquiry based instruction: Participating SSI states in the PER process evidenced hands-on, inquiry-based instruction being used in K-12 classrooms. Overall, states documented ongoing professional development programs to provide science and mathematics teachers experiences in this teaching approach, particularly through external evaluation efforts, including surveys and classroom observations. The **Connecticut SSI** reported technical assistance teams working in the districts, schools, and classrooms to ensure that instructional practices are consistent with the districts' approved curriculum. The **Puerto Rico SSI** informed that the model curricula developed by the Initiative follow a constructivist approach to the teaching/learning process that emphasizes inquiry and cooperative learning methods—professional development provided offers first hands-on, inquiry-based teaching/learning methodology. The **New York SSI** promoted inquiry-based instruction through the statewide summer institutes and the research and demonstration institutes as well. The **South Carolina SSI** indicated that 90% of the surveyed principals responded that the hubs' support has significantly increased the amount of inquiry-oriented, hands-on science and mathematics. Likewise, the **Texas SSI** developed guidelines for the preparation of prospective elementary teachers in both mathematics and science that stressed hands-on, inquiry-based instruction. Nevertheless, the frequency and amount of the observations made at the classroom level was not enough in any of the instances to ensure that the inquiry-based instruction that is promoted through the various professional development programs is actually implemented in

classrooms. More and better quality data about this indicator need to be gathered and interpreted to document this indicator.

(c) Assessments: Some states reported recently made efforts to develop and adopt new assessment systems aligned with the new state standards and frameworks. Efforts of this nature are illustrated by the states of **New Jersey, South Carolina, Arkansas,** and **Vermont** with entire new assessment systems oriented towards the science and mathematics standard. Similarly, **Louisiana** is radically changing its state assessment policies and practices, including s. aligning mathematics and science CRTs with the new standards-based curricular frameworks, formally adopted in 1996 and 1997. In 1998, **Massachusetts** will adopt the *Massachusetts Comprehensive Assessment System*, which is based directly upon learning standards contained in the curriculum frameworks. Moreover, in **Connecticut**, the *Mastery Tests* are designed to assess essential standards-based subjects, including mathematics. In grade 10, a science assessment addresses major goals, including conceptual understanding, applications, and experimentation. Other sites, such as **Puerto Rico**, provide professional development for teachers on standards-based assessment to ensure its use at the classroom level. Regardless of these major efforts, the need to effectively align state, district, school, and classroom assessments is evident. SSI states currently face the challenging issue of using data from non-standards-based assessment systems at the state level to evaluate and judge their standards-based efforts at the district, school, and classroom levels.

(d) Student support: Every state documented activities to support students in science and mathematics. **Texas**, for example, implements the *Advancement Via Individual Determination* program designed to give students who ordinarily would not be in rigorous academic college-preparatory classes the opportunity to take such classes and the support necessary to succeed in them. **Arkansas** has developed a consolidated state plan to bring together a variety of funding sources to benefit student learning which requires the coordination of resources from Title I, Eisenhower, Drug Education, and other resources. **New Jersey's SSI** school districts, such as South Brunswick, have implemented strategies to provide special support to students in mathematics and science. This school district identified algebra as a critical course for promoting equity, but recognized that at-risk students would have initial difficulties with the subject and institutes a summer programs to introduce these students to the topic and prepare them for potential pitfalls. Nevertheless, the frequency and quality of these programs, especially with regard to their direct connection with ongoing systemic reform efforts represent a concern to the SSI states.

(e) Use of environments and resources outside of schools: Some significant level of productive activity was reported with regard to the use of informal resources directly tied to curricular objectives. In **Vermont**, it has been essential to reach out to a maximum informal science providers, which now serve as a support system to schools and teachers, including the *Montshire Museum*, the *Vermont Institute for Natural Science* and the *Vermont Math Coalition*, for teacher internships at science and mathematics-based businesses statewide. In **Connecticut**, at least 54 districts have been identified that are

providing some type of organized evening, Saturday, or summer educational experience that is standards-based. In addition, in **Massachusetts**, every SSI district is encouraged to develop local partnerships with business, local *School-to-Work* partnership groups, museums, higher education institutions, parent groups, and adult education centers. Moreover, in **New Jersey**, systemic improvement districts have seen explosive growth in the use of Internet to link students and teachers to outside resources.

(f) Student-teacher-curriculum interactions: Every reporting SSI state described the extent to which changes identified in previous indicators have occurred at the classroom level. **Vermont**, for instance, indicates that evidence has been gathered through the school partnership benchmarking process and other data surveys that indicates substantial levels of change at the classroom level. **Texas**' model of statewide systemic reform considers individual schools as the unit of change. School-wide change, however, involves more than just the interaction of students, teachers, and curricula. Indeed, they believe that the environmental context of the school, as well as the community in which the school is embedded, act as critical components in successful school-wide change efforts. **Louisiana** indicated that it is through the interaction, integration, and implementation of combinations of changes that reform is realized and sustained. During its six year life, the program has built a critical mass of agents for change through the teachers and schools involved in the professional development projects and related curriculum, technology, and partnership projects. **Arkansas** reported that observations made by staff and the external evaluator, as well as by participants at various Leadership Academies, provide evidence that systemic educational changes have been brought together at the level of the classroom to benefit student achievement. **Massachusetts** pointed out that changes that have been supported by the SSI in that State have led to the writing of the frameworks, played a key role in creating a new assessment system, and provided new models and standards for professional development and teacher leadership—all of which has accelerated change at the classroom level. Finally, **New Jersey** informed that direct observation reports on classroom interactions in all systemic improvement districts reflected significant changes and meaningful improvements.

(g) System environment/context: All of the SSI states provided information and explained how and why the SSI Program is the unitary mathematics and science education leading initiative. However, evidence shared on other indicators, such as use of resources, for example, did not favor some of the arguments presented. Nevertheless, it can be stated that if not the unitary science and mathematics system at the present moment, because there are still fundamental issues to address regarding this assessment, all the SSI states seem to be moving in that direction. The best illustrations were made by **Massachusetts** and **New Jersey**, both with an internal/external operation system.

8. Student performance: Almost all of the SSI states reported student achievement gains during 1997, mainly by using data gathered from current statewide systems. In **Louisiana**, for example, the Initiative has monitored the *Louisiana Educational Assessment Program* (LEAP) mathematics test data for 5th and 7th grade students identified as having SSI teacher-participants. This system, currently undergoing

significant revision, has revealed over five years (1993-1997) that the 5th and 7th grade scores of those students identified as SSI teachers' students outscored students of non-SSI teachers. In general, but not in all cases, the score differentials proved to be higher for African-Americans and for those on free or reduced lunch status. That the SSI Program has particularly benefited traditional "low achievers" is also shown by consistent and substantial lower failure rates for SSI students on the LEAP test, especially at the 7th grade. **Connecticut's** student academic performance on multiple state and national assessments has continued to show steady gains since 1991. Scores have been increasing on a range of indicators, including the CMT, the CAPT, and the NAEP. Since 1993, the first year of the improved CMT, 4th grade student results have improved 6%, from 53% of the State's students meeting goal, to 59% in 1996. In grade six, there has been a 7% performance increase, from 45% reaching goal in 1993, to 52% in 1996. Grade eight growth, while less, has increased 5%, from 46% of students meeting goal in 1993, to 51% in 1996. The CMT student performance increases are occurring within all of the SSI districts. The four core districts all show increases in grade four and eight. The increases range from 66% in grade four in New Haven, to a 9% increase in Waterbury. The **Massachusetts SSI** informed that MEAP test results in 1996 revealed that between 1992 and 1996, the percentage of students performing at proficiency level 2 or above increased in both mathematics and science at all three grade levels tested (4, 8, and 10). Increases in the percentage of students at level 2 or above ranged from 3% in tenth grade mathematics and science, to 8% in 4th grade mathematics and 13% in 4th grade science. At fourth and eighth grades, the aggregate improvement for cohorts of districts that had participated in the SSI for more than two years was greater than that for the State as a whole, while at 10th grade, the SSI districts kept pace with the State in mathematics and slightly outpaced the State in science. Likewise, the **Puerto Rico SSI** indicates that in 1994, the *Puerto Rico Assessment of Educational Progress*, a translated version of the NAEP, was administered to a representative sample of 12,000 fourth and eighth grade students participating in the SSI Program, regular public, and private schools. The results demonstrated that eighth grade SSI students performed significantly better than those from non-SSI students and that they reduced in half the performance gap that exists between public and private schools in mathematics and by one third the gap in science. The 1997 administration results of this system are currently being analyzed. Similarly, the **Texas SSI** informed that students have made exceptional gains in mathematics as measured by the *Texas Assessment of Academic Skills* (TAAS). The percentage of students meeting minimum expectations on TAAS mathematics tests for grades 3 through 8 has increased by at least 30% at each grade level; the percentage has also increased by 26% at grade 10.

In **Arkansas**, as a result of the increased participation of middle-school teachers in the *Mathematics* and *Science Crusades*, scores improved from 1993 to 1995. Using the *Stanford 8* achievement test in the spring of 1993 and in the fall of 1995, seventh grade students showed improvement from 50 to 53 percentile points in mathematics and from 57 to 63 percentile points in science. In addition, using the *Stanford 9* achievement test data from the fall of 1996 and the fall 1997, students in grades 5, 7, and 10 improved their mathematics and science performance. In addition, in a study made by the **New Jersey**

SSI's internal evaluation, several areas were examined with regard to the student impact of participation in both K-8 professional development and district systemic improvement initiatives. The study reflected that schools involved in neither initiative showed 3.7% reduction in percentage of students scoring not proficient on the mathematics component of the *Early Warning Test* (EWT) between 1994 and 1996. Schools involved in professional development showed a 4.4% reduction in percentage of students scoring not proficient on the mathematics; and schools involved in both initiatives showed a 8.5% drop in percentage of students scoring not proficient on the mathematics component of the same test. **South Carolina** utilizes the *Metropolitan Achievement Tests* (MAT7) in grades 4, 5, 7, 9, and 11. In addition, the *Basic Skills Assessment Program* (BSAP) assesses student performance on statewide objectives in reading, mathematics, writing, and science for grades 3,6,8, and 10. Between 1994 and 1997, the percent of students meeting standards on the BSAP Science Test has increased on each of the grades tested: 3,6, and 8. In mathematics, between 1995 and 1997, the percentage of students scoring above the 50th national percentile on the MAT7 increased in grades 4, 5, and 7. Also, the percent of fourth grade African-American students scoring in the upper quarter increased eight percent points form 1995 to 1997.

Although student achievement gains have been demonstrated, it is important to underscore the fact that the testing systems used for this purpose are not standards-based assessment systems and that attribution to the SSI Program may seem premature in some instances.

9. Partnerships: Establishing partnerships and collaborations have been a successful and productive SSI activity. Parent organizations, community-based organizations, professional associations, business, industry, and the higher education sector have responded positively in support of the science and mathematics reform agenda promoted by the SSI Program. The development of strong local partnerships that support and enhance classroom practice is a basic tenet of the SSI in **Massachusetts**. On the district level, every leadership team is urged to include partners from the business, museum, higher education, adult education, and parent communities. All partners participate in leadership team planning. Museums and higher education partners lead in providing professional development to district teachers. Parent partners and teachers co-train other parents to run *Family Math* and *Family Science* nights. In the same way, the **Texas SSI** and the *Charles A. Dana Center* seek and win contracts and grants that shape the manner in which large amounts of monies are expended on education and education reform in the State. Also, through the *Building a Presence for Science Project*, a collaboration between the SSI, the NSTA, and the *Exxon Education Foundation*, teachers have received professional development on the *National Science Education Standards*. Furthermore, the **New York SSI** has distributed brochures and other information to parents to help them understand how the new science and mathematics standards influence classroom learning; **New Jersey** has developed effective partnerships with 14 higher education institutions to provide professional development to K-12 teachers; and **South Carolina** has made significant coordination with the business sector through its 13 hubs. **Connecticut** reported that on August 7, 1997, the *State Board of Education* adopted a new policy statement on "School-Family-Community Partnerships", which includes a

recommendation that schools take the lead in developing programs related to six standards, including parenting, communicating, volunteering, learning at home, decision making, and collaborating with the community. As another example of effective partnership, all major universities are active members of the *Resource Center for Science and Engineering*, an alliance of the major higher education institutions in **Puerto Rico**, facilitating and strengthening the SSI Program.

Partnerships focus on grassroots community organizations in most of the SSIs. These partnerships were established early and have been nurtured and expanded. Each of the SSIs also has a significant partnership with at least one major business/industry in the state. Outreach has been sought through newspapers, television programs, and direct dissemination to parents.

III. Program Synthesis: Implications and Emerging Issues

The following issues emerged from the analysis of the 1998 SSI PER process:

Theory of reform, the vision, and the unit of change: The majority of the SSI states explained the theory of reform that supports the systemic science and mathematics reform agenda. While describing the vision of science and mathematics education at various levels (e.g., classroom, school, system), each SSI identified its unit of change. **Massachusetts, New Jersey, Connecticut**, and **Arkansas** defined the school district as the fundamental systemic reform unit of change, whereas **Puerto Rico, Texas, Vermont, New York**, and **South Carolina** identified the school as that unit. Only one state, **Louisiana**, defined the teacher as the unit of change.

Despite the aforementioned units of change, the descriptions of the science and mathematics education visions consistently reflected the same elements. Nonetheless, assisting the states to define the ultimate unit of change is an essential step that the SSI Program needs to take in the very immediate future. Operationally, the identification of a given unit of change (e.g., school, school district, teacher) demands a particular action plan and defines a unique scaling-up plan as well. Defining the unit of change as that element of the system that must be changed as a necessary condition for altering content, teaching, and assessment in classrooms (e.g., the teacher) is considerably different from stating that the unit of change is the component of the system that must be changed in order to assure self-sustained support and accountability of systemic reform beyond the life of the SSI (e.g., the school district).

Equity: Other than describing the science and mathematics vision of high-quality education for all students in a rhetoric fashion in most of the instances, scarce reference, if any, was made during the PER process to the SSIs' particular efforts to ensure equitable participation of every student in excellent science and mathematics education. Almost no information or evidence was provided in terms of specific strategies or measures taken to infuse equity throughout the entire initiatives and reflect this critical element in every single component of the systemic reform enterprise. Equity, as a central and essential

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element of reform needs to be moved from its current "add-on" status to an inherent constituent of the entire science and mathematics educational reform activity.

The SSI as the science and mathematics unitary program: SSI states evidenced progress in the area of leveraging resources and converging them towards the mathematics and science unitary program that they are attempting to implement statewide. However, stronger policies and measures need to be in place to ensure that this happen, especially with regard to the use of categorical funds, such as Title I. In some states, the information provided indicated how much of these funds are being used under the SSI Program, but also suggested the utilization of significant amounts of these funds for purposes other than those promoted by the SSI.

Transition to standards-based science and mathematics curricula: In spite of the fact that most of the SSI states have made significant progress in the implementation of standards-based science and mathematics curricula to date, the statewide impact is still limited. Even those states that have made notable progress in this respect have only reached slightly over 50% of the school districts with full implementation of standards-based curricula. States such as **Louisiana** and **Connecticut** are beginning to make some progress in this direction; **Massachusetts** and **Puerto Rico**, with the most notable progress in this area, have to scale-up rapidly in order to reach a notable portion of the student population. A similar situation is faced by **Arkansas, Vermont, New Jersey,** and **South Carolina**. In addition, the process of transitioning to standards-based curricula requires that schools, as fundamental units of change, conceptualize and develop the school science and mathematics program before beginning the process of selection and implementation of standards-based curricula.

Transition from micro-activities to macro-activities (Scaling-up): Every SSI needs to address the issue of extending its initial efforts in order to become a statewide enterprise. Moving from an initial, predetermined number of schools or school districts to a larger, significant number of school or school districts capable of implementing a standards-based, high-quality mathematics and science for all students requires a well-designed strategic plan and represents a major challenge for all existing SSIs.

Infusion of technology into science and mathematics instruction: SSI written reports and oral presentations during the 1998 PER process revealed that states still need to develop a vision of technology as an inherent component of systemic reform. The use of technology as a tool to advance the understanding of mathematics and science at the classroom level was not clearly conveyed or evidenced by the SSI states. Rather, the notion of a collection of isolated technology projects and strategies to experiment with various aspects of technology seemed to be a recurring pattern.

Standards-based assessments: Regardless of the progress made by SSI states in terms of the use of standards-based assessments to gather student achievement data aligned with standards-based curriculum and instruction, this issue is still one that requires special attention. Some states have very recently designed or adopted new assessment systems

aligned with the national standards that will eventually provide more reliable student performance data. Nevertheless, the misalignment among assessment systems used at the state level, district-wide, school-wide, and in classrooms prevails. The understanding of assessment standards as well as the design, development, adoption, and effective use of standards-driven systems and tools need to be aggressively addressed.

Evaluation (Internal/External): Although substantive evidence and documentation related to accomplishments by the SSI states were presented during the 1998 PER process, evaluation, overall, is viewed as an ongoing issue. It was not totally clear, from the information provided by participating states, how the data gathered throughout the year regarding the various components of any of the systemic initiatives are effectively utilized to facilitate learning at the classroom level. Moreover, the ultimate use of student achievement data, even among those states that have significantly evolved in this direction, is unclear. How does this information flow into the classroom and how it is used by administrators and teachers is still an issue. Likewise, documentation and relevant data in terms of teachers behaviors in classrooms as a result of the massive professional development programs being promoted by the SSIs is yet to be improved, both in quantity and quality.

IV. Other critical issues related to the PER process

Guidance to Cohort III SSIs as a result of the PER findings: The following major systemic reform issues are viewed as emphases for the Cohort-III SSIs during FY 1998:

1. Accomplishment of the transition from capacity building or infrastructure to full implementation, including an assessment of the systemic reform "enablers", such as policies; the mathematics and science standards-based curriculum frameworks; standards-based student assessment systems; aligned and distributive professional development processes; accountability measures; and resource convergence to yield a unitary mathematics and science education reform process.

2. Assessment of the following specific, fundamental issues that must be successfully addressed by any SSI at the completion of its fifth year of implementation:

   - based on implementation to date, strategies (with explicit measures of achievement) to fully implement the mathematics and science standards-based, inquiry-focused curricula throughout the classrooms of the participating schools of the state's districts;

   - institutionalization (process, deliverables, and milestones) of the aforementioned mathematics and science curricula for all students (equity is embedded in the requisite educational processes) via use of appropriate mathematics and science instructional materials, educational resources, and the K-12 mathematics and science standards-based curriculum frameworks;

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- the appropriate incorporation of learning technologies into mathematics and science instructions;

- institutionalization (process, deliverables, and milestones) of standards-based mathematics and science student assessment systems;

- systemic-reform-directed professional development strategies to yield the total mathematics and science instructional workforce consistent with full implementation throughout the system;

- strategies (with deliverables) to assess both the progress of and productivity of systemic reform of the extant system; and

- the distributive organizational process/structures for the achievement of rapid replication, innovation, and overall system-wide or state-wide scale-up.

Assistance to Phase II SSIs: Guidance and special assistance to the Phase II (Cohorts I & II) SSIs will focus on the following areas:

1. Assist the states to implement and accomplish the following sets of activities, consistent with NSF/ESR's systemic reform expectations:

    - broadly- based strategies to institutionalize the systemically reformed, standards-based, inquiry-centered, math and science education instructional program (a unitary activity) throughout the classrooms of the participating K-12 schools of the state's districts;

    - strategies to develop a professional continuum to teacher development, integrating recruitment to a teacher education program; preservice preparation; teachers licensing; new teachers induction; ongoing professional development; and advanced certification of teachers based on performance.

    - progressive and appropriate infusion of learning technologies into math and science instructions throughout the participating entities of the SSI;

    - full implementation of standards-based mathematics and science student assessment(s) independent of local and state student assessment requirements unless each is appropriately standards-based;

    - strategies to better assess the orderly progression toward maturation and the unit productivity of systemic reform of the extant system, including full accommodation of specificity as its bears on the strategic actions- outputs continuum;

- the distributive organizational processes/structures necessary for the achievement of predictable and orderly innovation replication and overall system-wide or state-wide scale-up to yield a fully reformed (mature), standards- based, high-performance system effectively serving of the (participating) students upon the completion of Phase II of the respective SSI;

- development of the capacity to demonstrate/disseminate best practices, results, procedures, products, and services in order to assist other states with the replication of these outcomes in a systemic fashion:
  (a) identification, evaluation, selection, and implementation of standards-based curriculum;
  (b) identification and selection of standards-based assessment systems;
  (c) design, development, and implementation of a standards-based, research-centered professional development program;
  (d) alignment of curriculum, professional development, and assessment;
  (e) scaling-up strategies; and
  (f) establishment of policies and measures to support systemic reform; and

- ensuring high-quality of the entire enterprise.

The Vermont SSI: As a result of the 1998 PER, ESR projects to take various actions in order to ensure that SSI states successfully achieve the objectives of their science and mathematics reform agenda. In addition to the special assistance that will be provided to both Phase II states and Cohort III sites, ESR will conduct a comprehensive evaluation of the SSI in Vermont to assess the Initiative's infrastructure and to ensure its capacity to transition to full statewide implementation. The assistance and evaluation of the VT SSI will include the following aspects:

(i) the design and utilization of broad-based strategies to fully implement the mathematics and science standards-based, inquiry-focused curricula throughout the classrooms of the participating school districts;
(ii) institutionalization of the aforementioned mathematics and science curricula for all students;
(iii) institutionalization of standards-based student assessments;
(iv) strategies to assess both the progress and productivity of systemic reform of the extant system; and
(v) capacity to replicate successful strategies, products, and processes statewide.

The need for an SSI Impact Study: ESR plans to initiate the design and implementation of a study aimed at describing and explaining the connection among the SSI infrastructure, the transition from that infrastructure to full implementation and scale-up, and student achievement. The following preliminary outline is being analyzed:

A Proposed Statewide Systemic Initiative (SSI) Program Evaluative Study

I. Assessment of the progress achieved to date with regard to the original objectives of the SSI Program as stated in the FY 1990 Program Solicitation.
   - A. To encourage improvements in science, mathematics, and technology education through comprehensive systemic changes in the education systems of the states.
   - B. Encourage coherent and consistent policies and programs by identifying the elements that, if taken together, will make a difference in what students know and are able to do.
     1. A vision of science and mathematics education
     2. curriculum goals and content
     3. instructional strategies
     4. assessment of student learning
     5. changes in school structure and decision-making to promote effective teaching and learning
     6. equity as a central and inherent issue to systemic reform
     7. policy changes in support of high-quality science and mathematics education
     8. adoption of new mew methods and standards for the preparation and continuing development of teachers and administrators
   - C. Creation of effective partnerships
   - D. Plan for implementing and evaluating results
   - E. Determining impact on student achievement

II What have we accomplished to date in terms of each of the systemic reform components include in the "drivers"?
   - A. curriculum
   - B. assessment
   - C. professional development
   - D. policies
   - E. partnerships
   - F. resources
   - G. data gathering, interpretation, and use
   - H. student achievement
   - I. equity
   - J. scaling-up
   - K. institutionalization

III Validity and Attribution of Student Achievement Data
   - A. Progressive increases in student mathematics achievement
   - B. Progressive increases in student science achievement
   - C. Statistical analyses of student achievement data
   - D. Selective impacts of the SSI Program

E. Validity of the SSI attribution

IV. Lessons Learned

A. What have we learned about systemic reform?

B. What works and under what circumstances, especially with regard to the following systemic reform components and the relationship and dependence among them?

1. curriculum
2. assessment
3. professional development
4. policies
5. partnerships
6. resources
7. data gathering, interpretation, and use
8. student achievement
9. equity
10. scaling-up
11. institutionalization

V. How can we share our learnings with other states to assist them reforming their educational systems through a systemic approach?

A. What are the fundamental elements?

B. What is the most effective process?

C. How would the "how-to-do-it" kit look like?

The need for a plan to ensure sustained interaction with post-SSI awardees: The SSI Program was initiated in FY 1991 with 10 states. A total of 25 states and the Commonwealth of Puerto Rico received SSI awards for terms of up to 5 years of funding and of up to approximately $2.0 million per year. As the states completed their 5-year agreement with NSF, the Phase II competitions (to date, NSF has conducted the Phase II process with Cohort-I and Cohort-II SSIs; proposals for Cohort-III states are due on February 2, 1998), and the phase-out process, the SSI FY 1998 includes only 11 SSI states.

The Foundation plans to continue relationships with SSI awardees as they complete their cooperative agreements and afterwards, as follows:

1. Continuing Contact: The NSF has made a significant investment in each of the SSIs. Each has made significant progress in the areas described earlier. While this progress is not always complete, it has resulted from considerable efforts, and should prove valuable to each state in its continuing efforts to improve its K-12 education. The Foundation believes that it will serve well all of the state, city, and regional systems with which it is working to maintain contact with SSI states, even when no further NSF support for their SSI as a whole may be forthcoming. Therefore, ESR will maintain contact with each of the SSI states that desires it. For example, each will be

invited to PI meetings; receive communications sent to the SSIs; and be kept as an active member of electronic and other networks.

2. Component Development: The SSIs have developed many useful means for improving K-12 science and mathematics education in their states. In many cases, components have begun under the SSI that could not be completed given its resources or duration. The ESR program directors will work with SSIs desiring it to consider other sources of EHR support for completing or extending components of the SSI. These sources may provide the means by which major portions of the SSI agendas in a state could be completed.

   Existing Programs. When a state has begun one or more activities under the SSI award and desires to continue it, the state's NSF SSI program director will, upon request, facilitate discussions with program directors in EHR who work in the relevant program. Such common needs as teacher enhancement, teacher preparation, and materials development are already organized as programs within EHR.

   Cross-program Support. There is also a mechanism within EHR for considering proposals that cut across its existing divisional units. A state interested in this possibility should consult with its SSI program directors for advice about this process.

3. Continuing as Partners with Others: ESR will also encourage the involvement of the SSIs in the various reform programs underway in their states, including the Urban Systemic Initiatives (USI); the Rural Systemic Initiatives (RSI); Local Systemic Change Projects; Collaboratives for Excellence in Teacher Preparation; or Networking Infrastructure for Education programs, as well as reforms supported through other federal agencies; through private foundations, business, and industry; and by the states themselves.
4. Completion of Exemplary Systemic Development: While EHR does not deem it desirable that even exemplary efforts depend on NSF support indefinitely, it is recognized that any *a priori* period of time is at best an estimate of how long systemic reform may take. As a consequence, we are prepared to continue support to systemic initiatives that have made substantial progress until the sustainability of the initiative is highly probable. EHR is not prepared to support, however, a steady-state reform effort.

The Foundation will design and implement a plan including other strategies and activities that may ensure the accomplishment of this objective in a more effective manner.

V. Appendices

A. **The 1998 PER indicators:** The FY 1998 PER indicators as described in Dr. Luther S. Williams, Acting Director, Division of Educational System Reform and Assistant Director, Education and Human Resources, memorandum of November 3, 1997 (Re: Fiscal Year 1998 Program Effectiveness Reviews) are:

1. **Student impact:** number of students reached presently with full implementation (based on drivers) and percentage relative to baseline number of students in system; number and percentage of students presently affected by global system changes. (Core data elements submissions I and II should be used in responding to this indicator; emphasis is on full implementation of a standards-based, inquiry-centered math and science education instructional program and that the percentage of students participating in such a fully implemented system relative to the total student pool defines the scale of the systemic reform impact.)
2. **Teacher impact :** number of teachers involved presently in full implementation (based on drivers) and percentage relative to the baseline of the number of teachers in the system, number and percentage of teachers affected by global system changes. [Teacher impacts should be explicated as a continuum of systemic activities relative to the baseline on year one; the core data elements submissions would be useful inputs for this indicator. Moreover, the progressive transition from ill-defined, short term to research-informed, intensive (60 hours or more) to sustained professional development in a systemic domain coupled to student performance is another crucial issue for this indicator.]
3. **Policy changes:** m/s graduation requirements; removal of remedial courses; professional development requirements; teacher certification changes; accountability measures for all system levels, other policies which impact implementation. (It would be useful to frame the policy changes in a chronology in parallel with specific program objectives/actions.)
4. **Resource changes (both increase and alignment):** increase in percent of budget; how are targeted funds such as Title I, Perkins, Eisenhower spent and percentage of total of each used in direct support of SSI, USI, or RSI; other measures could include things such as change in student teacher ratio; use of other professionals inside and outside system; facilities including math and science learning technologies.
5. **Management change:** cabinet level position overseeing implementation; increase in m/s supervisors, coordination of other parts of the system with SSI, USI, or RSI.
6. **Data utilization:** data collected relative to implementation; who collects; evidence that data is used in formative evaluation and change in strategic plan; validity of attributions based on data interpretations/use, site-specific program evaluation. (Reference to the data reported in the core data element submissions is recommended.)
7. **Learning infrastructure change:**
   (a) **Standards-based curriculum:** what is the evidence that the curriculum is standards-based (should include description of what it is); extent of its implementation in classroom; evidence of ancillary support including provision of materials, support from principals, lead teachers, changing in school schedule needed for effective delivery (Framing the response as a fractional

representation of the total system being impacted would enhance the specificity of the response.)

(b) **Hands-on, inquiry based instruction:** evidence that teachers are being appropriately trained in this pedagogy; evidence that this is occurring in classrooms; support for teachers in effective implementation including things such as teacher planning time, mentor teacher assistance, opportunity for continuing professional development.

(c) **Assessments:** what assessments are used; alignment with curriculum and instruction; training of teachers in their use; assessment feedback to teachers so that they may use to individualize instruction; other state or district mandated assessments notwithstanding, explain the math and science standards-based, instruction derived, assessment system used for the SI. (Stated differently, what standards-based math and science assessments are used? If none, why not and what are the near term plans to appropriately assess the student performance outputs of the systemic reform enterprise?)

(d) **Student support:** in-school and other programs to support students as curriculum and course requirement changes are being implemented.

(e) **Use of environments and resources outside of schools:** extent of utilization of informal science resources directly tied to curricular objectives; internships and similar programs; outside human resources, other community-based resources.

(f) **Student-teacher-curriculum interactions:** indicators a-e speak to changes in components of the learning infrastructure. For this indicator, explicate the evidence detailing the extent to which these changes have been brought together at the level of the classroom as described in your description of the classroom implementation.

(g) **System environment/context:** place the SSI, USI, or RSI in the context of your entire system. To what extent is the initiative the unitary mathematics and science education system? How does it relate to vocational education, special education, Title I, and other targeted programs? Detail the number of students in these programs and the congruence of their curriculum, instruction and student assessment, graduation requirements and quality of the mathematics and science experience to the SSI, USI, or RSI.

8. **Student performance:** description of vehicles that are used to measure; evidence that they are valid; delta of student performance relative to a baseline at the start of the award with a discussion of the delta for the underserved relative to all students; alignment with changed curriculum and instruction; career choice information; job upon graduation or college attendance; graduation rates. (Employ the core data element II documentation and any other assessment/student achievement and accomplishment data in responding to this indicator.)
9. **Partnerships:** evidence of collaboration with parent organizations, community-based organizations and business-industry, and higher education in support of the reform.
10. **Summary Presentation:** Based on the responses given to the categorical indicators 1-9 above, provide summary representation of the progress (to date) toward the achievement of a unitary, standards-based, inquiry-centered, math and science

education system and justify this representation by use appropriate output/outcome/impact measures of systemic reform in a SSI, USI, or RSI site. [This response should include qualitative and quantitative (systemic metric) as appropriate.]

B. List of awards : The following is a list of the SSI awards, including award number, title, Principal Investigator, Project Director, and total funding.

- **Arkansas Department of Higher Education**, ESR-9350027
  - PI: Edward Crowe
  - PD: Suzanne Mitchell
  - TF: $9,750,000
  - PO: Julio E. López-Ferrao

- **Connecticut Academy for Mathematics, Science & Technology, Inc.**, ESR-9634086
  - PI: Steve Leinwand
  - PD: Richard Cole
  - TF: $2,700,000
  - PO: Celestine H. Pea

- **Louisiana Statewide Systemic Intiative (LaSiP),** ESR-9634088
  - PI/PD: Kerry Davidson
  - TF: $2,800,000
  - PD: L. Jody Chase

- **Massachusetts Department of Education,** ESR-9712003
  - PI: David Driscoll
  - PD: Thomas Noonan
  - TF: $2,600,000/24 month award
  - PO: Celestine H. Pea

- **New Jersey Statewide Systemic Initiative,** ESR-9350023
  - PI: Gerald Goldin
  - PD: Deborah Cook
  - TF: $9,999,991
  - PO: Julio E. López-Ferrao

- **New York State Board of Education,** ESR-9350033
  - PI: Edward Lalor
  - PD: Richard Jones
  - TF: $10,000,000.
  - PO: Gerald E. Gipp

- **Puerto Rico Statewide Systemic Initiative,** ESR-9711999
  - PI: Manuel Gómez
  - PD: Pablo Rivera
  - TF: $2,560,000
  - PO: Gerald E. Gipp

- **South Carolina Statewide Systemic Initiative,** ESR-9350042
  PI/PD: Marc Drews
  TF: $10,000,000
  PO: Julio E. López-Ferrao

- **Texas Systemic Initiative,** ESR-9712001
  PI: Uri Philip Treisman
  PD: David Hill
  TF: $9,600,000
  PO: Linda S. Warner

- **Vermont Statewide Systemic Initiative,** ESR-9711997
  PI/PD: Frank Watson
  TF: $1,072,712
  PO: Julio E. López-Ferrao